NPS3005-Q100

0.5 V to 5.5 V, 6 A, 15 mΩ, single channel load switch with soft start

Rev. 1 — 10 June 2025 Product data sheet

1. General description

NPS3005-Q100 is a single channel load switch with an adjustable soft start. It contains a 6 A continuous current rated N-channel MOSFET that can operate over an input voltage range of 0.5 V to 5.5 V.

NPS3005-Q100 is controlled by an EN pin which supports down to 1.2 V control voltage.

NPS3005-Q100 provides stable On-resistance with an extra BIAS pin operating from 1.5 V to 5.5 V.

NPS3005-Q100 integrates over temperature protection. The internal MOSFET will be turned off when the junction temperature exceeds 160 ºC and will be turned on automatically when the junction temperature drops by 20 ºC.

NPS3005-Q100 integrates an 230 Ω on-chip resistor between output and ground pin for Quick Output Discharge (QOD) when the switch is turned off.

The NPS3005-Q100 is offered 8 pin 2 mm x 2 mm HWSON8 package with thermal pad for better thermal conductivity. this product family is characterized for operation over a -40 ºC to +105 ºC ambient temperature range.

2. Features and benefits

- Automotive product qualification in accordance with AEC-Q100
  - Specified from -40 °C to +105 °C
- Bias voltage range: 1.5 V to 5.5 V
- Input voltage range: 0.5 V to 5.5 V
- Maximum continuous current (I_{MAX}) : 6 A
- 15 mΩ (typical) on-resistance
- 1.2 V control logic compatible
- Adjustable soft start
- Quick output discharge
- Thermal shutdown
- ESD protection:
  - HBM ANSI/ESDA/JEDEC JS-001 exceeds 2000 V
  - CDM ANSI/ESDA/JEDEC JS-002 exceeds 1000 V
- SOT8067-1 (HWSON8) with thermal pad (plastic thermal enhanced very very thin Small Outline packages, no leads; 8 terminals; 0.5 mm pitch; 2.0 mm x 2.0 mm x 0.75 mm body)

3. Applications

- Automotive electronics
- ADAS (Advanced Driver Assistance Systems)
- Infotainment

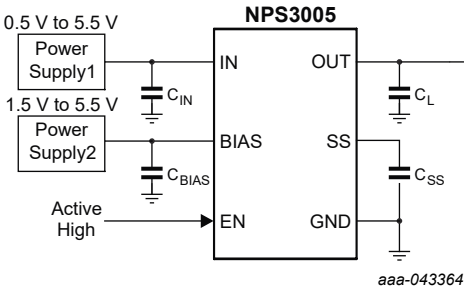


Fig. 1. Typical application circuit

4. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
NPS3005GP-Q100	-40 °C to +105 °C	HWSON8	Plastic thermal enhanced very very thin small outline package; no leads; 8 terminals; 0.5 mm pitch, 2.0 × 2.0 × 0.75 mm body	SOT8067-1

5. Marking

Table 2. Marking

Type number	Marking code
NPS3005GP-Q100	s35

6. Selection guide

Table 3. Selection guide

Type number	Enable	R_{ON}	I_{MAX}	QOD
NPS3005GP-Q100	Active high	15 mΩ	6 A	YES

7. Functional diagram

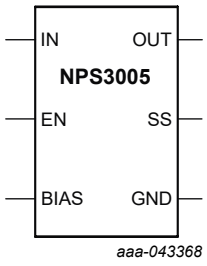


Fig. 2. Logic symbol

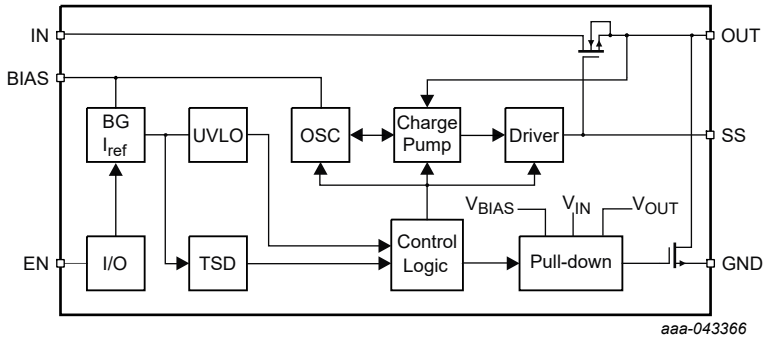
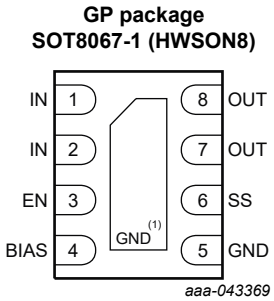


Fig. 3. Functional diagram

8. Pinning information

8.1. Pinning



Transparent top view

(1) This is not a ground pin, the thermal pad (exposed center pad) should be connected to GND.

Fig. 4. Pin configuration SOT8067-1 (HWSON8)

8.2. Pin description

Table 4. Pin description

Symbol	Pin	IO	Description
IN	1, 2	I	Input power supply. At least 1 µF input bypass ceramic capacitor recommended for minimizing V_{IN} dip.
EN	3	I	Enable input of switch. Active High to enable NPS3005-Q100. Do not leave floating.
BIAS	4	I	Supply voltage to internal control circuit.
GND	5		Ground pin of the circuitry. All voltage levels are measured with respect to this pin. Connect externally to Power PAD
SS	6	O	Soft start control of switch. A capacitor from this pin to ground sets the V_{OUT} rise slew rate.
OUT	7, 8	O	Output to the load.
PAD	-	PAD	Connect Thermal PAD to ground externally to have better thermal performance.

9. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).[1]

Symbol	Parameter	Conditions	Min	Max	Unit
V_{IN}	input voltage		–0.3	6	V
V_{OUT}	output voltage		–0.3	6	V
V_{BIAS}	bias voltage		–0.3	6	V
V_{EN}	enable voltage		–0.3	6	V
I_{MAX}	maximum continuous switch current		-	6	A
I_{PLS}	maximum pulsed switch current	pulse <300 µs; 2% duty cycle	-	8	A
T_j	junction temperature		-	150	°C
T_{stg}	storage temperature		–65	150	°C

[1] Stresses beyond those listed under Limiting values may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

10. ESD ratings

Table 6. ESD ratings

Symbol	Parameter	Conditions	Value	Unit
V_{ESD}	electrostatic discharge voltage	HBM: ANSI/ESDA/JEDEC JS-001 class 2	±2000	V
		CDM: ANSI/ESDA/JEDEC JS-002 class C3	±1000	V

11. Recommended operating conditions

Table 7. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Max	Unit
V_{IN}	input voltage		0.5	V_{BIAS}	V
V_{BIAS}	bias voltage		1.5	5.5	V
V_{EN}	enable voltage		0	5.5	V
V_{OUT}	output voltage		-	V_{IN}	V
V_{IH}	HIGH level input voltage	EN pin	1	5.5	V
V_{IL}	LOW level input voltage	EN pin	0	0.4	V
T_{amb}	ambient temperature		–40	105	°C

12. Recommended components

Table 8. Recommended components

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
C_{IN}	capacitor on pin IN		-	1	-	µF
C_{OUT}	capacitor on pin OUT		-	0.1	-	µF
C_{BIAS}	capacitor on pin BIAS		-	1	-	µF
C_{SS}	capacitor on pin SS		0	-	100	nF

13. Static characteristics

Table 9. Static characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	T_{amb}	Min	Typ	Max	Unit
Power supply and current, V_{BIAS} = 5 V							
$I_{Q(BIAS)}$	quiescent current	BIAS pin; no load; $V_{IN} = V_{EN}$ = 5 V	–40 °C to +105 °C	-	37	45	µA
$I_{SD(BIAS)}$	shutdown current	BIAS pin; $V_{EN} = V_{OUT}$ = 0 V	–40 °C to +105 °C	-	0.5	2.3	µA
$I_{SD(IN)}$	off-state supply current	IN pin; $V_{EN} = V_{OUT}$ = 0 V					
		V_{IN} = 5 V	–40 °C to +85 °C	-	0.87	6.9	µA
			–40 °C to +105 °C	-	7.3	22	µA
		V_{IN} = 3.3 V	–40 °C to +85 °C	-	0.6	4.5	µA
			–40 °C to +105 °C	-	5.2	15	µA
		V_{IN} = 1.8 V	–40 °C to +85 °C	-	0.44	2.5	µA
			–40 °C to +105 °C	-	4.2	8.5	µA
		V_{IN} = 0.5 V	–40 °C to +85 °C	-	0.33	2	µA
			–40 °C to +105 °C	-	3.3	7	µA
I_{EN}	input leakage current	EN pin; V_{EN} = 5.5 V	–40 °C to +105 °C	-	-	0.1	µA
$V_{EN(hys)}$	input hysteresis voltage	EN pin; V_{IN} = 5 V	25 °C	-	120	-	mV
R_{PD}	output pull-down resistance	V_{IN} = 5 V, V_{EN} = 0 V	–40 °C to +105 °C	-	230	320	Ω
T_{SD}	thermal shutdown	junction temperature rising	-	-	160	-	°C
$T_{SD(hys)}$	thermal shutdown hysteresis	junction temperature falling	-	-	20	-	°C

Symbol	Parameter	Conditions	T_{amb}	Min	Typ	Max	Unit
Power supply and current, V_{BIAS} = 2.5 V							
$I_{Q(BIAS)}$	quiescent current	BIAS pin; no load; V_{IN} = V_{EN} = 2.5 V	25 °C	-	18	27	µA
			–40 °C to +105 °C	-	23	32	µA
$I_{SD(BIAS)}$	shutdown current	BIAS pin; V_{EN} = V_{OUT} = 0 V	25 °C	-	0.2	0.6	µA
			–40 °C to +105 °C		0.3	1	µA
$I_{SD(IN)}$	off-state supply current	IN pin; V_{EN} = V_{OUT} = 0 V					
		V_{IN} = 2.5 V	–40 °C to +85 °C	-	0.51	2.9	µA
			–40 °C to +105 °C	-	4.6	9.5	µA
		V_{IN} = 1.8 V	–40 °C to +85 °C	-	0.44	2.5	µA
			–40 °C to +105 °C	-	4.2	8.5	µA
		V_{IN} = 0.5 V	–40 °C to +85 °C	-	0.33	2	µA
			–40 °C to +105 °C	-	3.2	7	µA
I_{EN}	input leakage current	EN pin; V_{EN} = 5.5 V	–40 °C to +105 °C	-	-	0.1	µA
$V_{EN(hys)}$	input hysteresis voltage	EN pin; V_{IN} = 2.5 V	25 °C	-	85	-	mV
R_{PD}	output pull-down resistance	V_{IN} = 2.5 V, V_{EN} = 0 V	–40 °C to +105 °C	-	230	340	Ω
T_{SD}	thermal shutdown	junction temperature rising	-	-	160	-	°C
$T_{SD(hys)}$	thermal shutdown hysteresis	junction temperature falling	-	-	20	-	°C

Symbol	Parameter	Conditions	T_{amb}	Min	Typ	Max	Unit
Power supply and current, V_{BIAS} = 2 V							
$I_{Q(BIAS)}$	quiescent current	BIAS pin; no load; $V_{IN} = V_{EN}$ = 2 V	25 °C	-	18	25	µA
			–40 °C to +105 °C	-	22	30	µA
$I_{SD(BIAS)}$	shutdown current	BIAS pin; $V_{EN} = V_{OUT}$ = 0 V	25 °C	-	0.2	0.6	µA
			–40 °C to +105 °C	-	0.3	1	µA
$I_{SD(IN)}$	off-state supply current	IN pin; $V_{EN} = V_{OUT}$ = 0 V					
		V_{IN} = 2 V	–40 °C to +85 °C	-	0.46	2.8	µA
			–40 °C to +105 °C	-	4.3	9.5	µA
		V_{IN} = 1.8 V	–40 °C to +85 °C	-	0.44	2.5	µA
			–40 °C to +105 °C	-	4.2	8.5	µA
		V_{IN} = 1.2 V	–40 °C to +85 °C	-	0.39	2.3	µA
			–40 °C to +105 °C	-	3.8	8	µA
		V_{IN} = 0.5 V	–40 °C to +85 °C	-	0.33	2	µA
			–40 °C to +105 °C	-	3.3	7	µA
I_{EN}	input leakage current	EN pin; V_{EN} = 5.5 V	–40 °C to +105 °C	-	-	0.1	µA
$V_{EN(hys)}$	input hysteresis voltage	EN pin; V_{IN} = 2 V	25 °C	-	80	-	mV
R_{PD}	output pull-down resistance	V_{IN} = 2 V, V_{EN} = 0 V	–40 °C to +125 °C	-	230	360	Ω
T_{SD}	thermal shutdown	junction temperature rising	-	-	160	-	°C
$T_{SD(hys)}$	thermal shutdown hysteresis	junction temperature falling	-	-	20	-	°C
Power supply and current, V_{BIAS} = 1.5 V							
$I_{Q(BIAS)}$	quiescent current	BIAS pin; no load; $V_{IN} = V_{EN}$ = 1.5 V	25 °C	-	57	70	µA
			–40 °C to +105 °C	-	70	85	µA
$I_{SD(BIAS)}$	shutdown current	BIAS pin; $V_{EN} = V_{OUT}$ = 0 V	25 °C	-	0.15	0.5	µA
			–40 °C to +105 °C	-	0.2	1	µA
$I_{SD(IN)}$	off-state supply current	IN pin; $V_{EN} = V_{OUT}$ = 0 V					
		V_{IN} = 1.5 V	–40 °C to +85 °C	-	0.42	2.5	µA
			–40 °C to +105 °C	-	4	8.5	µA
		V_{IN} = 0.5 V	–40 °C to +85 °C	-	0.33	2	µA
			–40 °C to +105 °C	-	3.3	7	µA
I_{EN}	input leakage current	EN pin; V_{EN} = 5.5 V	–40 °C to +105 °C	-	-	0.1	µA
$V_{EN(hys)}$	input hysteresis voltage	EN pin; V_{IN} = 1.5 V	25 °C	-	70	-	mV
R_{PD}	output pull-down resistance	V_{IN} = 1.5 V, V_{EN} = 0 V	–40 °C to +125 °C	-	230	440	Ω
T_{SD}	thermal shutdown	junction temperature rising	-	-	160	-	°C
$T_{SD(hys)}$	thermal shutdown hysteresis	junction temperature falling	-	-	20	-	°C

Symbol	Parameter	Conditions	T_{amb}	Min	Typ	Max	Unit
ON resistance (R_{ON}), V_{BIAS} = 5 V							
R_{ON}	ON resistance	I_{OUT} = –200 mA, V_{BIAS} = 5 V					
		V_{IN} = 5 V	25 °C	-	15	19	mΩ
			–40 °C to +85 °C	-	-	23	mΩ
			–40 °C to +105 °C	-	-	25	mΩ
		V_{IN} = 3.3 V	25 °C	-	15	19	mΩ
			–40 °C to +85 °C	-	-	23	mΩ
			–40 °C to +105 °C	-	-	25	mΩ
		V_{IN} = 2.5 V	25 °C	-	15	19	mΩ
			–40 °C to +85 °C	-	-	23	mΩ
			–40 °C to +105 °C	-	-	25	mΩ
		V_{IN} = 1.8 V	25 °C	-	15	19	mΩ
			–40 °C to +85 °C	-	-	23	mΩ
			–40 °C to +105 °C	-	-	25	mΩ
		V_{IN} = 1.5 V	25 °C	-	15	19	mΩ
			–40 °C to +85 °C	-	-	23	mΩ
			–40 °C to +105 °C	-	-	25	mΩ
		V_{IN} = 1.2 V	25 °C	-	15	19	mΩ
			–40 °C to +85 °C	-	-	23	mΩ
			–40 °C to +105 °C	-	-	25	mΩ
		V_{IN} = 0.5 V	25 °C	-	15	19	mΩ
			–40 °C to +85 °C	-	-	23	mΩ
			–40 °C to +105 °C	-	-	25	mΩ
ON resistance (R_{ON}); V_{BIAS} = 2.5 V							
R_{ON}	ON resistance	I_{OUT} = –200 mA, V_{BIAS} = 2.5 V					
		V_{IN} = 2.5 V	25 °C	-	20	26	mΩ
			–40 °C to +85 °C	-	-	32	mΩ
			–40 °C to +105 °C	-	-	34	mΩ
		V_{IN} = 1.8 V	25 °C	-	18	23	mΩ
			–40 °C to +85 °C	-	-	29	mΩ
			–40 °C to +105 °C	-	-	31	mΩ
		V_{IN} = 1.5 V	25 °C	-	18	22	mΩ
			–40 °C to +85 °C	-	-	28	mΩ
			–40 °C to +105 °C	-	-	30	mΩ
		V_{IN} = 1.2 V	25 °C	-	18	22	mΩ
			–40 °C to +85 °C	-	-	27	mΩ
			–40 °C to +105 °C	-	-	29	mΩ
		V_{IN} = 0.5 V	25 °C	-	17	21	mΩ
			–40 °C to +85 °C	-	-	26	mΩ
			–40 °C to +105 °C	-	-	27	mΩ

Symbol	Parameter	Conditions	T_{amb}	Min	Typ	Max	Unit
ON resistance (R_{ON}); V_{BIAS} = 2 V							
R_{ON}	ON resistance	I_{OUT} = –200 mA, V_{BIAS} = 2 V					
		V_{IN} = 1.8 V	25 °C	-	20	-	mΩ
			–40 °C to +85 °C	-	-	-	mΩ
			–40 °C to +105 °C	-	-	35	mΩ
		V_{IN} = 1.2 V	25 °C	-	20	-	mΩ
			–40 °C to +85 °C	-	-	-	mΩ
			–40 °C to +105 °C	-	-	35	mΩ
		V_{IN} = 0.5 V	25 °C	-	20	-	mΩ
			–40 °C to +85 °C	-	-	-	mΩ
			–40 °C to +105 °C	-	-	35	mΩ
ON resistance (R_{ON}); V_{BIAS} = 1.5 V							
R_{ON}	ON resistance	I_{OUT} = –200 mA, V_{BIAS} = 1.5 V					
		V_{IN} = 1.5 V	25 °C	-	22	-	mΩ
			–40 °C to +85 °C	-	-	-	mΩ
			–40 °C to +105 °C	-	-	36	mΩ
		V_{IN} = 1.2 V	25 °C	-	22	-	mΩ
			–40 °C to +85 °C	-	-	-	mΩ
			–40 °C to +105 °C	-	-	36	mΩ
		V_{IN} = 0.5 V	25 °C	-	22	-	mΩ
			–40 °C to +85 °C	-	-	-	mΩ
			–40 °C to +105 °C	-	-	36	mΩ

14. Dynamic characteristics

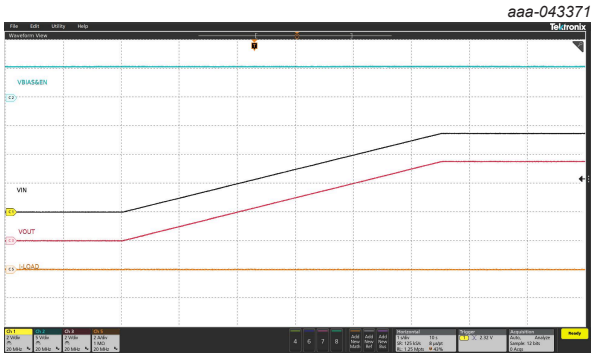
Table 10. Dynamic characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V);

Symbol	Parameter	Conditions	T_{amb} = 25 °C			Unit
			Min	Typ	Max	
t_{ON}	turn ON time	R_L = 10 Ω, C_L = 0.1 µF, C_{IN} = 1 µF, C_{SS} = 1 nF, V_{EN} = 5 V, 50% V_{EN} to 50% V_{OUT}				
		V_{IN} = V_{BIAS} = 5 V	-	1450	-	µs
		V_{IN} = V_{BIAS} = 2.5	-	2180	-	µs
t_{OFF}	turn OFF time	R_L = 10 Ω, C_L = 0.1 µF, C_{IN} = 1 µF, C_{SS} = 1 nF, V_{EN} = 5 V, 50% V_{EN} to 50% V_{OUT}				
		V_{IN} = V_{BIAS} = 5 V	-	2	-	µs
		V_{IN} = V_{BIAS} = 2.5	-	2	-	µs
t_R	output rise time	R_L = 10 Ω, C_L = 0.1 µF, C_{IN} = 1 µF, C_{SS} = 1 nF, V_{EN} = 5 V, 50% V_{EN} to 50% V_{OUT}				
		V_{BIAS} = 5 V, V_{IN} = 1.5 V	-	595	-	µs
		V_{BIAS} = 5 V, V_{IN} = 1.8 V	-	700	-	µs
		V_{BIAS} = 5 V, V_{IN} = 3.3 V	-	1190	-	µs
		V_{BIAS} = 5 V, V_{IN} = 5 V	-	1750	-	µs
		V_{BIAS} = 2.5 V, V_{IN} = 2.5 V	-	2150	-	µs
t_F	output fall time	R_L = 10 Ω, C_L = 0.1 µF, C_{IN} = 1 µF, C_{SS} = 1 nF, V_{EN} = 5 V, 50% V_{EN} to 50% V_{OUT}				
		V_{BIAS} = 5 V, V_{IN} = 5 V	-	2	-	µs
		V_{BIAS} = 2.5 V, V_{IN} = 2.5 V	-	2	-	µs

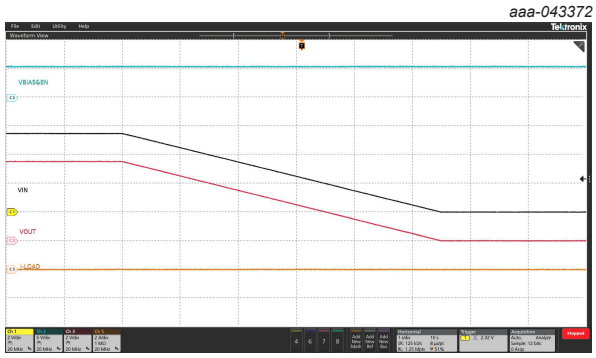
Symbol	Parameter	Conditions	T_{amb} = 25 °C			Unit
			Min	Typ	Max	
$t_{D(EN)}$	EN delay time	R_L = 10 Ω, C_L = 0.1 µF, C_{IN} = 1 µF, C_{SS} = 1 nF, V_{EN} = 5 V, 50% V_{EN} to 50% V_{OUT}				
		V_{BIAS} = 5 V, V_{IN} = 5 V	-	600	-	µs
		V_{BIAS} = 2.5 V, V_{IN} = 2.5 V	-	1120	-	µs

14.1. Typical characteristics



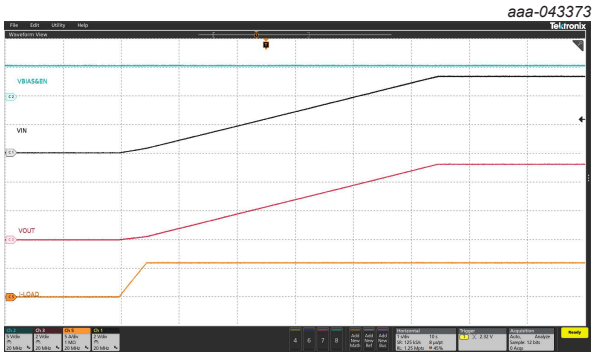
V_{BIAS} = V_{IN} = V_{EN} = 5.5 V, 0.001 V/ms, I_{Load} = 0 A

Fig. 5. Turn ON V_{IN}



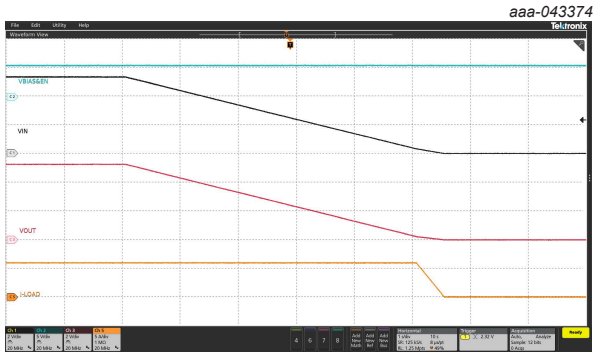
V_{BIAS} = V_{IN} = V_{EN} = 5.5 V, 0.001 V/ms, I_{Load} = 0 A

Fig. 6. Turn OFF V_{IN}



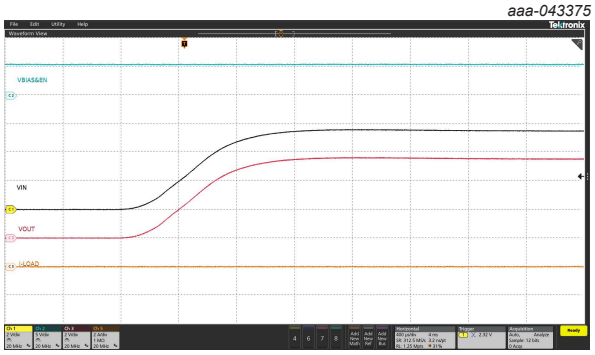
V_{BIAS} = V_{IN} = V_{EN} = 5.5 V, 0.001 V/ms, I_{Load} = 6 A

Fig. 7. Turn ON V_{IN}



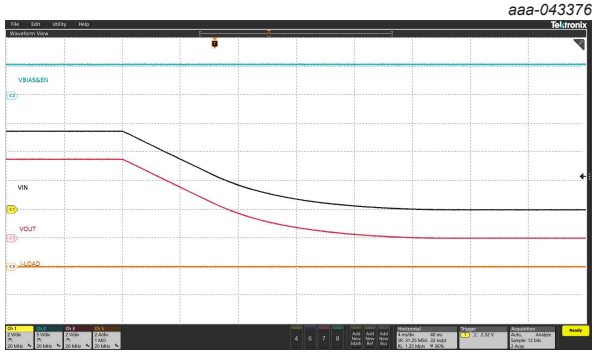
V_{BIAS} = V_{IN} = V_{EN} = 5.5 V, 0.001 V/ms, I_{Load} = 6 A

Fig. 8. Turn OFF V_{IN}



V_{BIAS} = V_{IN} = V_{EN} = 5.5 V, 10 V/ms, I_{Load} = 0 A

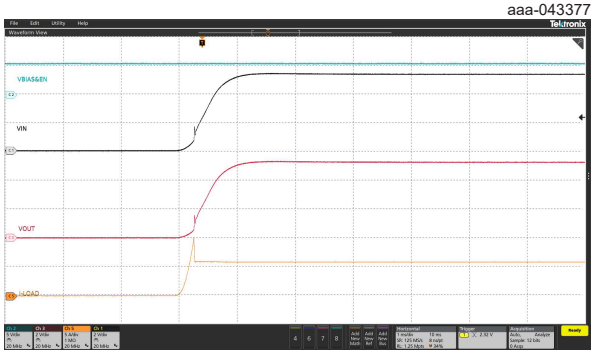
Fig. 9. Turn ON V_{IN}



V_{BIAS} = V_{IN} = V_{EN} = 5.5 V, 10 V/ms, I_{Load} = 0 A

Fig. 10. Turn OFF V_{IN}

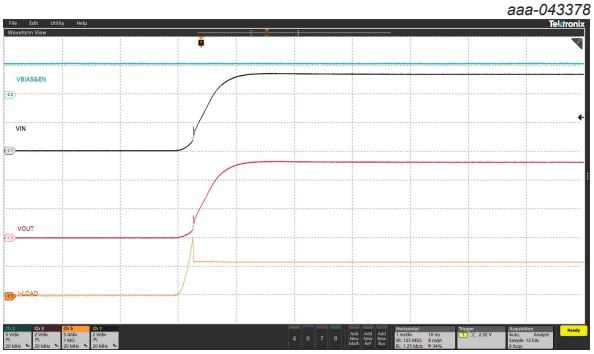
aaa-043377



V_{BIAS} = V_{IN} = V_{EN} = 5.5 V, 10 V/ms, I_{Load} = 6 A

Fig. 11. Turn ON V_{IN}

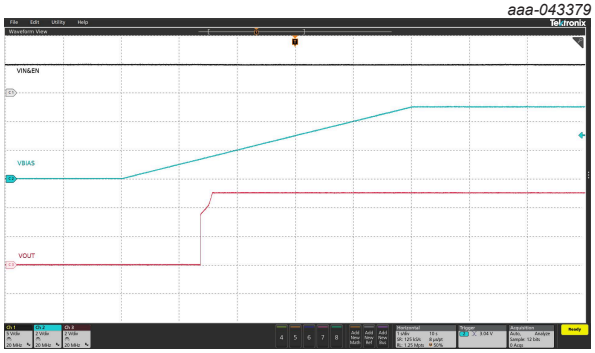
aaa-043378



V_{BIAS} = V_{IN} = V_{EN} = 5.5 V, 10 V/ms, I_{Load} = 6 A

Fig. 12. Turn OFF V_{IN}

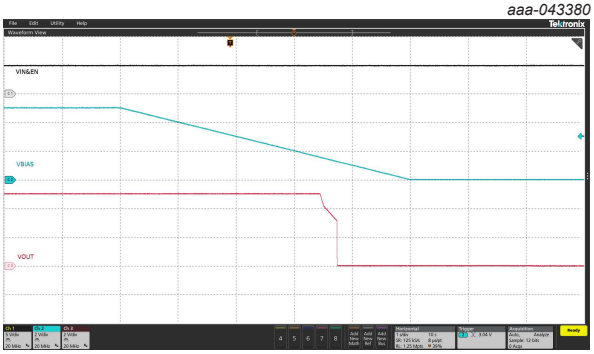
aaa-043379



V_{BIAS} = V_{IN} = V_{EN} = 5 V, 0.001 V/ms, I_{Load} = 0 A

Fig. 13. Turn ON V_{BIAS}

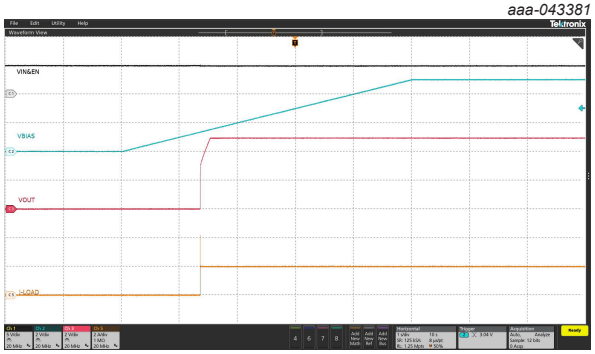
aaa-043380



V_{BIAS} = V_{IN} = V_{EN} = 5 V, 0.001 V/ms, I_{Load} = 0 A

Fig. 14. Turn OFF V_{BIAS}

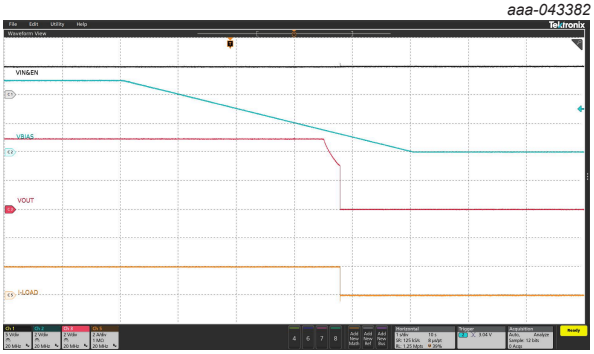
aaa-043381



V_{BIAS} = V_{IN} = V_{EN} = 5 V, 0.001 V/ms, I_{Load} = 2 A

Fig. 15. Turn ON V_{BIAS}

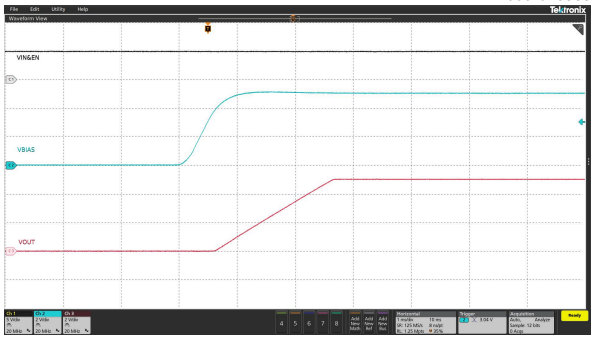
aaa-043382



V_{BIAS} = V_{IN} = V_{EN} = 5 V, 0.001 V/ms, I_{Load} = 2 A

Fig. 16. Turn OFF V_{BIAS}

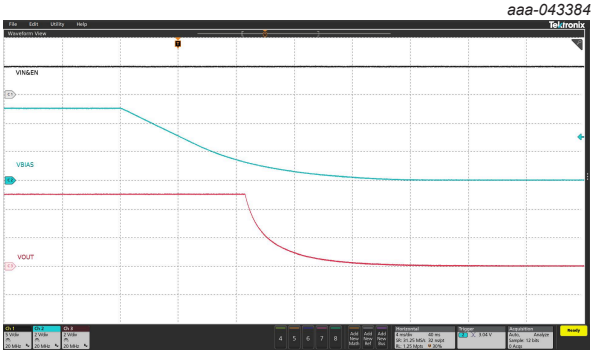
aaa-043383



V_{BIAS} = V_{IN} = V_{EN} = 5 V, 10 V/ms, I_{Load} = 0 A

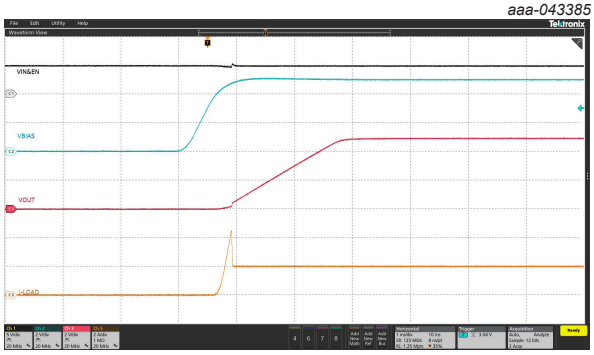
Fig. 17. Turn ON V_{BIAS}

aaa-043384



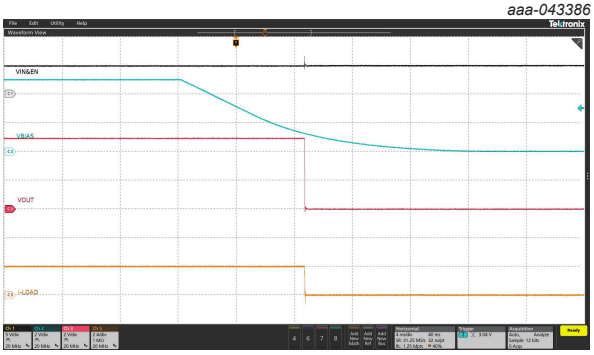
V_{BIAS} = V_{IN} = V_{EN} = 5 V, 10 V/ms, I_{Load} = 0 A

Fig. 18. Turn OFF V_{BIAS}



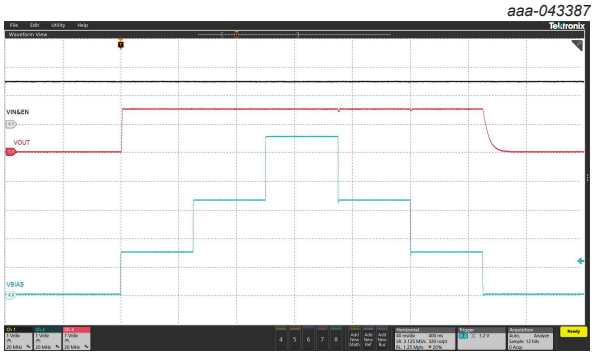
V_{BIAS} = V_{IN} = V_{EN} = 5 V, 10 V/ms, I_{Load} = 2 A

Fig. 19. Turn ON V_{BIAS}



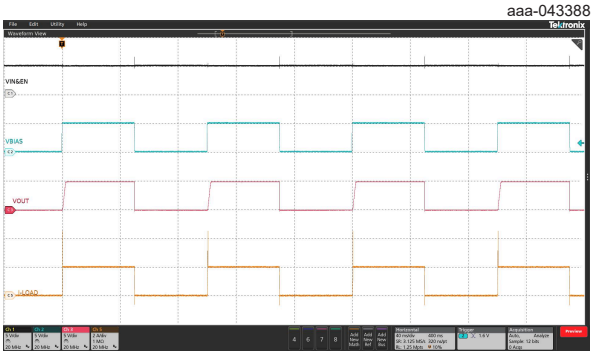
V_{BIAS} = V_{IN} = V_{EN} = 5 V, 10 V/ms, I_{Load} = 2 A

Fig. 20. Turn OFF V_{BIAS}



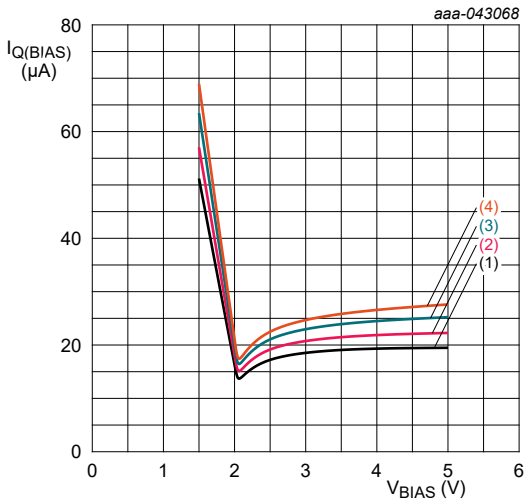
V_{EN} = V_{IN} = 1.5 V
V_{BIAS}: 0 V>1.5 V>3.3 V>5.5 V>3.3 V>1.5 V>0 V
R_L = floating

Fig. 21. V_{BIAS} transient



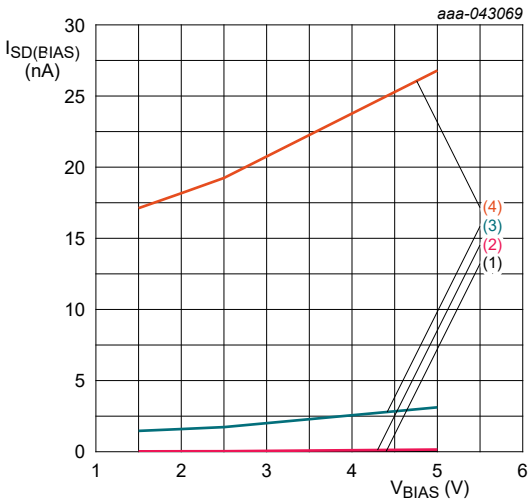
V_{EN} = V_{IN} = 5 V
V_{BIAS} = 5 V, 10 Hz
I_L = 2 A

Fig. 22. V_{BIAS} toggle



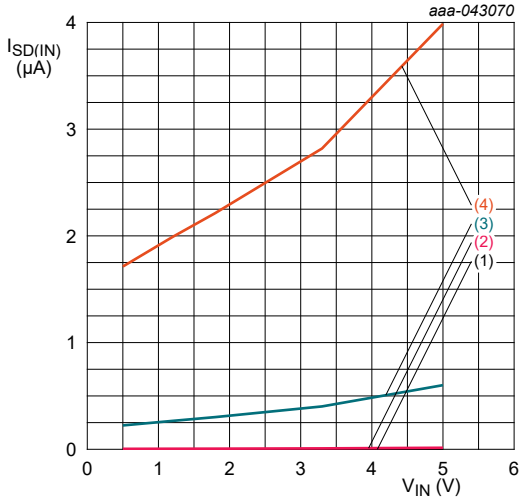
(1) T_{amb} = -40 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 85 °C
(4) T_{amb} = 105 °C

Fig. 23. BIAS quiescent current vs BIAS voltage



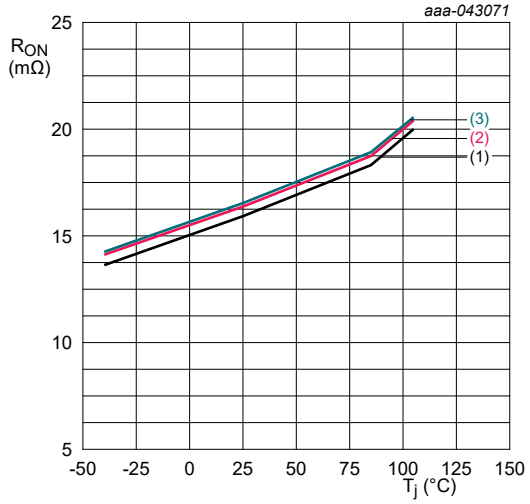
(1) T_{amb} = -40 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 85 °C
(4) T_{amb} = 105 °C

Fig. 24. BIAS shutdown current vs BIAS voltage



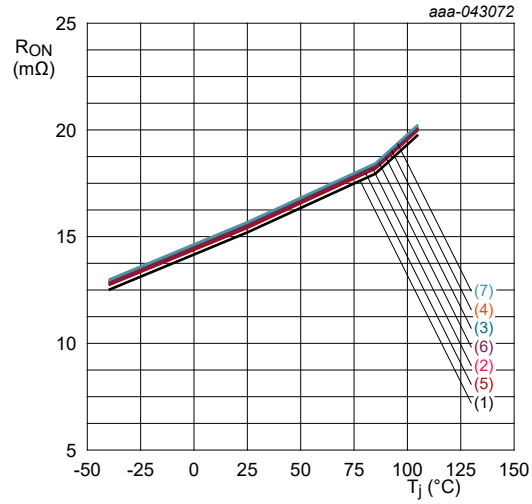
(1) T_{amb} = -40 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 85 °C
(4) T_{amb} = 105 °C

Fig. 25. VIN OFF-state supply current vs input voltage



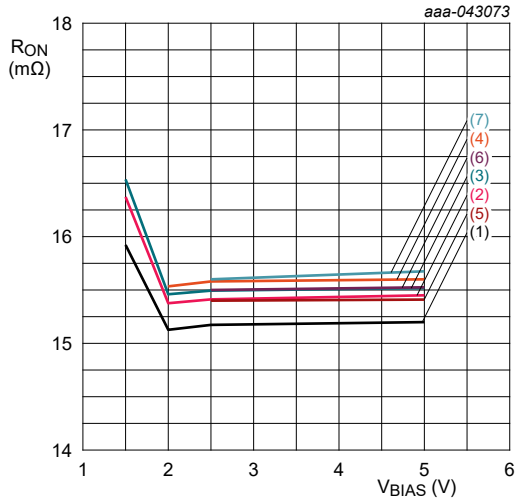
V_{BIAS} = 1.5 V
(1) V_{IN} = 0.5 V
(2) V_{IN} = 1.2 V
(3) V_{IN} = 1.5 V

Fig. 26. ON resistance vs ambient temperature



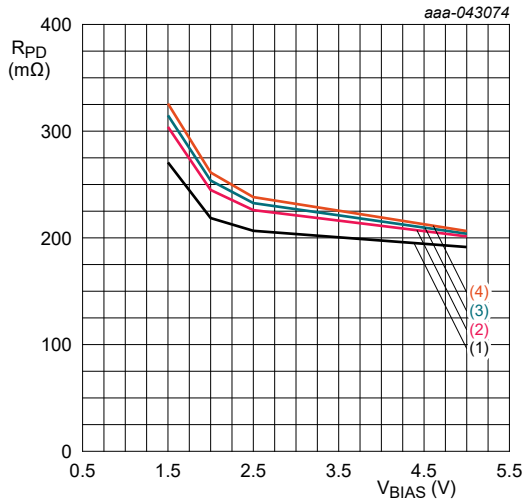
V_{BIAS} = 5 V
(1) V_{IN} = 0.5 V; (2) V_{IN} = 1.2 V
(3) V_{IN} = 1.5 V; (4) V_{IN} = 1.8 V
(5) V_{IN} = 2.5 V; (6) V_{IN} = 3.3 V
(7) V_{IN} = 5 V

Fig. 27. ON resistance vs ambient temperature



(1) V_{IN} = 0.5 V; (2) V_{IN} = 1.2 V
(3) V_{IN} = 1.5 V; (4) V_{IN} = 1.8 V
(5) V_{IN} = 2.5 V; (6) V_{IN} = 3.3 V
(7) V_{IN} = 5 V

Fig. 28. ON resistance vs BIAS voltage



(1) T_{amb} = -40 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 85 °C
(4) T_{amb} = 105 °C

Fig. 29. Output pull-down resistance vs BIAS voltage

15. Detailed description

15.1. Overview

The NPS3005-Q100 consists of a 6 A rated N-channel MOSFET (NMOS) transistor with single-channel. The device has configured adjustable slew rate for specific soft start. The OUT pin will be pulled low when the device is disabled. NPS3005-Q100 also has thermal shutdown to prevent any damage from overheating.

15.2. Functional diagram

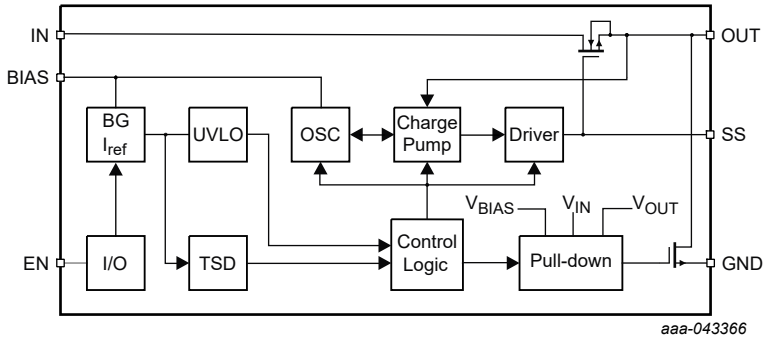


Fig. 30. Functional diagram

15.3. Feature description

Enable (EN)

The logic enable (pin EN) circuit controls the power switch, a logic high (above 1 V) enables the internal MOSFET. The EN input is compatible with both TTL and CMOS logic levels.

Bias voltage range

To obtain a stable ON resistance, the NPS3005-Q100 introduces an additional bias pin, which is connected to the charge pump inside the chip to provide a stable supply voltage for the internal MOSFET.

It is highly recommended to keep the IN pin voltage not larger than the BIAS pin voltage. The device will still be functional if $V_{IN} > V_{BIAS}$ but the ON resistance will be larger.

Adjustable Soft Start

NPS3005-Q100 has built in adjustable Soft Start which helps to reduce output current peak, thus to reduce the voltage drop of the input voltage. Soft start time can be adjusted via an external capacitor connected between SS pin and GND. The quick output discharge feature not only prevents output pin from being floating when disabled but also helps to adjust falling time with an external resistor.

Quick output discharge

An internal 230 Ω pull-down resistor is connected between OUT pin and GND when the NPS3005-Q100 is disabled to prevent the OUT pin from being floating.

16. Application information

The typical application circuit is shown in Fig. 31. Component selection is explained below.

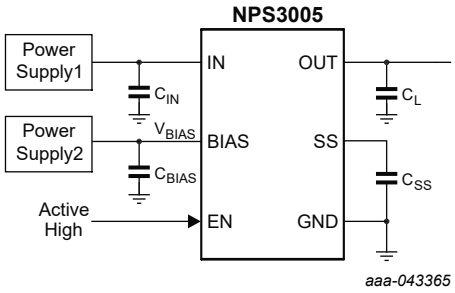
Input Capacitor

A capacitor of 10 µF or higher value is recommended to be placed close to the IN pins of NPS3005-Q100. This capacitor can reduce the voltage drop caused by the in-rush current during the turn-on transient of the load switch. A higher value capacitor can be used to further reduce the voltage drop during high-current application.

Output Capacitor

A capacitor of 1 µF or higher value is recommended to be placed between the OUT pins and GND. The switching times are affected by the capacitance. A larger capacitor makes the initial turn-on transient smoother. This capacitor must be large enough to supply a fast transient load to prevent the output from dropping.

Typical Application



V_{IN} = 1.8 V
V_{BIAS} = 5 V
C_{IN} = 10 µF
C_{BIAS} = 1 µF
C_L = 1 µF

Fig. 31. Typical application circuit

17. Layout

Power supply recommendations

The NPS3005-Q100 is designed to operate with a V_{IN} range of 0.5 V to 5.5 V, V_{BIAS} range of 1.5 V to 5.5 V. The V_{IN} and V_{BIAS} power supply must be well regulated and placed as close to the device terminal as possible. The power supply must be able to withstand all transient load current steps. In most situations, using an input capacitance (C_{IN}) of 1 µF is sufficient to prevent the supply voltage from dipping when the switch is turned on. In cases where the power supply is slow to respond to a large transient current or large load current step, additional bulk capacitance may be required on the input.

Layout guidelines

For best performance, all traces must be as short as possible. To be most effective, the input and output capacitors must be placed close to the device to minimize the effects that parasitic trace inductances may have on normal operation. Using wide traces for V_{IN}, V_{OUT}, and GND helps minimize the parasitic electrical effects.

Layout example

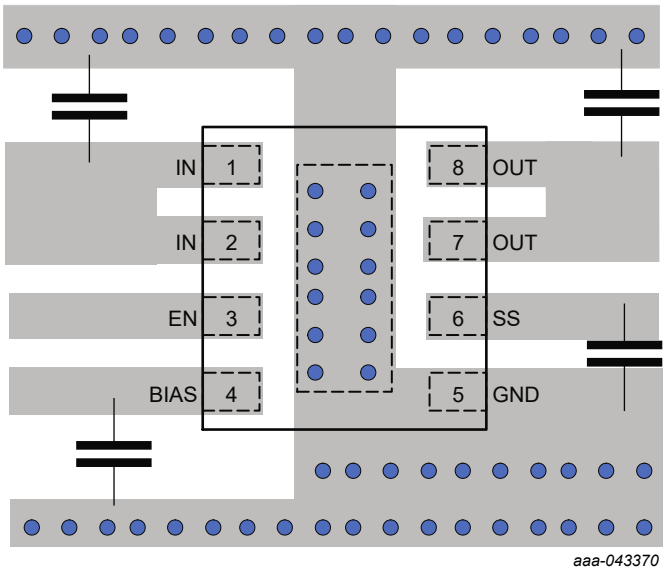


Fig. 32. Layout example

18. Thermal considerations

The maximum IC junction temperature should be restricted to 150 °C under normal operating conditions. To calculate the maximum allowable dissipation, $P_{D(max)}$ for a given output current and ambient temperature, the equation as shown below can be used:

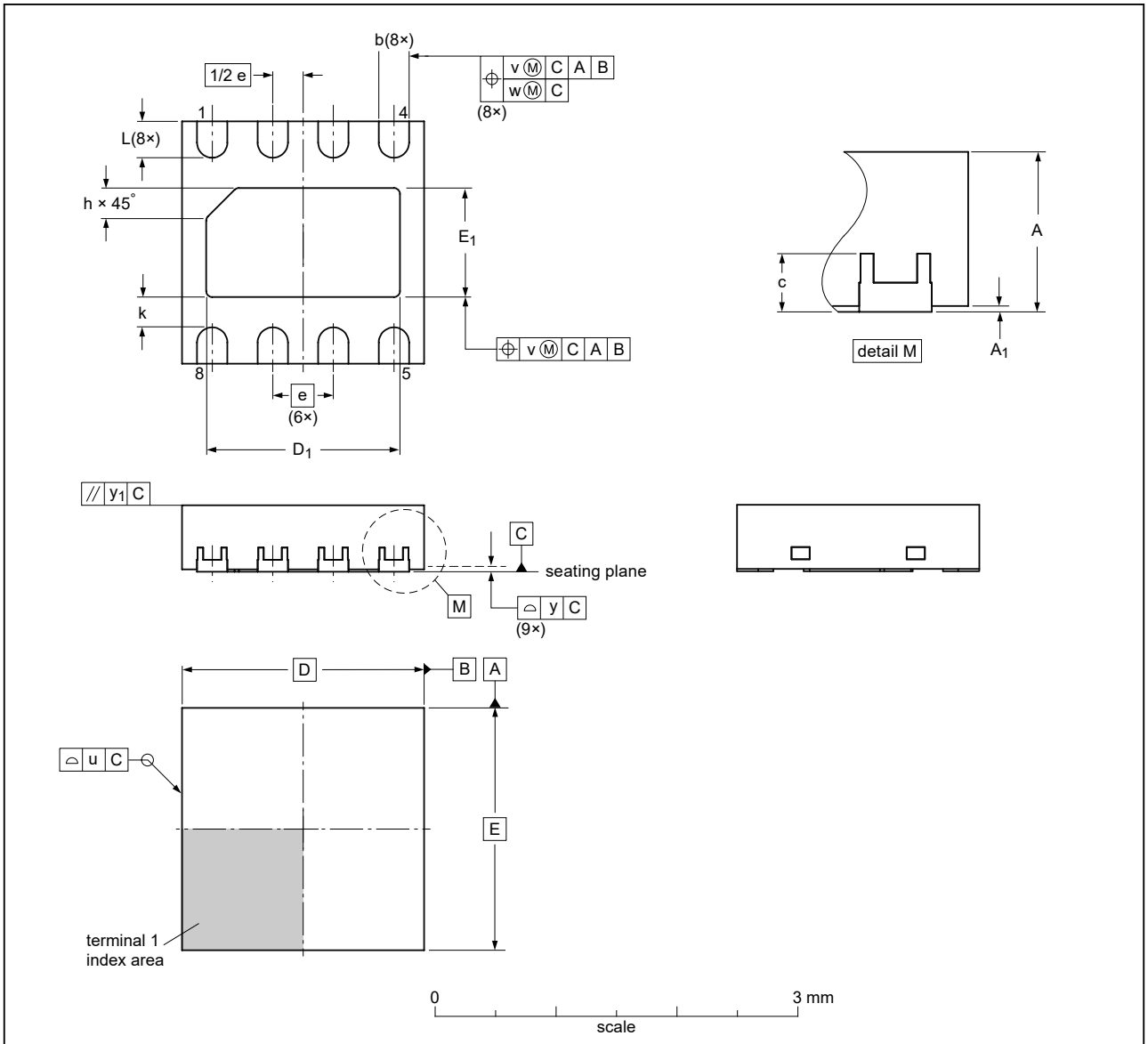
$$P_{D(MAX)} = \frac{T_{j(MAX)} - T_{amb}}{\theta_{JA}}$$

Where:

$P_{D(MAX)}$ = maximum allowable power dissipation
$T_{j(MAX)}$ = maximum allowable junction temperature (150 °C for the NPS3005-Q100 devices)
T_{amb} = ambient temperature of the device
θ_{JA} = junction to air thermal impedance. This parameter is highly dependent upon board layout.

19. Package outline

HWSON8: plastic thermal enhanced very very thin Small Outline packages, no leads; 8 terminals; 0.5 mm pitch; 2.0 mm x 2.0 mm x 0.75 mm body **SOT8067-1**



Dimensions (mm are the original dimensions)

Unit[1]		A	A_1	b	c	D	D_1	E	E_1	e	h	k	L	u	v	w	y	y_1
mm	max	0.80	0.05	0.30	0.2	2.0	1.7	2.0	1.0	0.5	0.25	0.25	0.4	0.1	0.1	0.05	0.05	0.05
	nom	0.75		0.25	REF	BSC	1.6	BSC	0.9	BSC	REF	REF	0.3					
	min	0.70	0	0.20			1.5		0.8				0.2					

sot8067-1_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT8067-1		MO-229				23-08-21

Fig. 33. Package outline SOT8067-1 (HWSON8)

20. Abbreviations

Table 11. Abbreviations

Acronym	Description
CMOS	Complementary Metal Oxide Semiconductor
TTL	Transistor-Transistor Logic
HBM	Human Body Model
ESD	ElectroStatic Discharge

21. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
NPS3005_Q100 v.1	20250610	Product data sheet	-	-

22. Legal information

Data sheet status

Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.
[2] The term 'short data sheet' is explained in section "Definitions".
[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the internet at https://www.nexperia.com.

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